by heat or numbed by cold. And when the agricultural resources of the country shall become developed, and the swamp lands reclaimed and brought under cultivation, I believe that every external influence, detrimental to the preservation of health, will be reduced to a minimum.

Table showing the number of cases of the principal diseases admitted into the State Hospital, Sacramento City, with their average mortality and duration of treatment.

	June.	July.	August.	September.	October.	November.	December.	Total.	Number of deaths. Per cent.	Average time of treatment.	Number of cases in Sacramento.
Intermittent fever		6	6	11	12	4	6	45	1.2	7 dys	5
Bilious remittent fever	4	6	21	21	38	18	8	116	4.3	8	6
Congestive fever		2		2				4	50.0	6	1
Typhus fever			1	4	12	5	11	33	39 7	13	3
Continued fever	3	2	2		1	2		10		9	1
Erysipelas			1	4	3	1	2	11	18.1	7	
Diarrhœa	3	1		1	1	3		9			
Chronic diarrhœa	4	3	2	3	5	3	1	21			
Dysentery	2	1	1		1	2	6	13	56		
Acute bronchitis						3		3	54		
Chronic bronchitis	1		2		1			4			
Pneumonia							5	5	100		
Pleurisy	1					1		2			
Acute rheumatism	9	3	2					14			
Chronic rheumatism	3	2	5	7	4		2	23			

Sacramento City, *March* 14, 1852.

Art. V.—*A Case of Saccharine Diabetes, with Tabular Observations of its Pathology, and the Results of Treatment.* By Charles Frick, M. D., Baltimore.

The following case of saccharine diabetes has been under my care, in the Maryland Penitentiary, for the past ten months. From the particular advantages for medical observation to be obtained in an institution of this character, inasmuch as the amount of exercise, diet, and labour is nearly equal from day to day, I have had better opportunities for obtaining comparative results, and am enabled to state more facts, in relation to this particular case, than could be ascertained elsewhere. And although I have not been able to deduce any explanation of the pathology of this disease which is much in advance of the theories which at present prevail, yet I feel assured that I am enabled, on the one side, to substantiate beyond doubt many of the facts recorded by previous observers, and on the other to settle definitely one or two disputed points. I should moreover state, at the commencement, that the quantity of

ingesta and egesta, as recorded in the tables, I am satisfied, is strictly correct, and whenever I had reason to suspect the least inaccuracy the observation was thrown aside as worthless.

Nicholas Matthews, mulatto, æt. 37 years, height six feet three inches, weight 180 lbs., entered the prison March 23, 1851, under a sentence of nine years. He is not fleshy, but strong and healthy in appearance. Previous to his confinement, he lived in the country, near the village of Ellicott's Mills. The soil is of granitic formation, and he worked most of his life in the open air as a stonecutter. His health, for the last nine years, has been so good that, during that time, he has not lost a day from sickness, and was enabled to do as full a task as any one working at the same occupation. Nine years ago he was treated for a pleurisy on the right side, which confined him to the house for two weeks, and he has, at this time, slight dulness on percussion on that side, from old false membranes. He has always been well fed and clothed, and has been a temperate man, for the last nine years having not once tasted ardent spirits. His diet consisted of vegetables, meat, and bread, and neither his appetite nor thirst could be considered inordinate. The meat was almost always salt, and the bread contained no yeast, he having ascertained that ordinary fermented bread was apt to occasion pain in his bowels. He says that his father had something like diabetes at the age of forty; but it passed off in a few years, and he is now alive at the age of eighty-four. None of his relatives died of phthisis. One brother, aged fifty-eight, is at present an inmate of the prison, sound and well in every respect, and another he lost from pneumonia. He had never noticed anything wrong about his urine, and is confident that he never passed any unusual amount before his confinement. About a year since, he remarked, for the first time, that he had occasion to rise once at night to empty his bladder. This has continued ever since. After the attack of pleurisy, he had attracted attention among his fellow-workmen from the fact of his excessive perspiration. Since his residence in the prison, his skin has been dry except in hot weather. For some years he has been subject to pain across the loins, and occasional cramps in the solei muscles. But these he attributes to an inguinal hernia which was produced about that time. The day of his entrance he was placed in the spinning-shop, where he continued for five weeks at work, when my attention was attracted to him. He had lost twelve pounds in weight, complained of great weakness in his knees, and inordinate appetite and thirst. This latter, he stated, had been so great that in the dormitory, where he could procure no water, he had drunk his own urine, which he described as being sweet to the taste. On testing it, I found it distinctly saccharine. He was then removed to the hospital for more accurate observation, and for three weeks was subjected to different kinds of diet without remedial treatment; every article of food eaten, and the exact quantity of urine discharged, being ascertained throughout the whole period. I ascertained that his lungs and heart were perfectly sound. There was no pain in his head, neck, or along the spinal cord, with or without pressure. The liver and spleen are of natural size, and all the abdominal organs, as far as I can discover, are in a normal condition. His health now is about as good as at entrance. At different periods of his confinement, I have examined the following fluids of his body for sugar. The test most commonly used was the addition of liquor potassæ and sulphate of copper, known as Trommer's. I also used Moore's test, the Barreswil liquid, yeast, and nitrate of silver. Of these, Barreswil's liquid gives the most satisfac-

tory results, provided the quantity added before heating be equal at least to one-third or one-fourth the quantity of urine.*

The urine was examined repeatedly, and always contained sugar, the amount holding a definite relation to the specific gravity.

The sweat was examined several times. Half a drachm collected by a spoon from his skin always gave the characteristic reaction.

An infusion made by pouring boiling water on the feces, filtering, and then boiling with animal charcoal to decolorize, always contained sugar. The largest quantity was obtained from the stools passed during an attack of cholera morbus.

On treating the contents of his stomach in the same way, whether ejected by cholera morbus or by an emetic, the characteristic reaction was always made evident. This was most marked in the matters thrown up a few hours after a meal, and was present when the diet consisted of meat and eggs alone. I think we may account for it in this case, by its presence in the mucus and gastric juice ejected at the same time.

While labouring under catarrh, the mucous expectoration from his bronchial tubes, on being diluted with water, gave the characteristic reaction.

This was also the case with the saliva, in every instance that I examined it. Bernard states that true saliva in this disease contains no sugar; but, as I was unable to separate the secretion obtained from the parotid and sublingual glands, and the buccal mucous membrane, I cannot assert that he is mistaken.

Blood was taken from him, in two instances, by cups. At both times it contained sugar, and gave the characteristic reaction in a more marked degree than any of the fluids examined. Its detection was very simple. About half a drachm of serum was diluted with half an ounce of water. This was heated to coagulate the albumen, filtered, and the test applied to the filtered fluid. Or, an ounce of blood was dried, pulverized, and alcohol poured on it. This was filtered and evaporated at a gentle heat; then dissolved in water. Only a few drops of this solution were necessary to indicate the presence of sugar.

From an abscess of the hand half a drachm of pus was collected. This was diluted, boiled, and filtered. The usual test gave the characteristic reaction.†

It is thus shown that all the secretions of his body which were available for examination indicated most decidedly the presence of sugar, and this without any relation to the diet, although the reaction was most marked when sugar or starch was used as food.

* The composition of the Barreswil fluid, for which I am indebted to Dr. Donaldson, is as follows:—

℞. Crystallized carbonate of soda ʒj, ℈j;
Caustic potash ʒij, ℈ij;
Bitartrate of potash ʒj, ℈ij;
Sulphate of copper ʒj;
Distilled water Oj.
M. To be boiled, and then filtered.

† I am aware that the reduction of the oxide of copper may be produced by other organic substances besides sugar, and that from the presence of albumen false inferences may be drawn. Such, I am satisfied, is not the case in the present instance.

Table Exhibiting the Influence of Diet.

Date.	Hour of day.	Urine passed in ounces in 24 hours.	Fluid drank, in ounces.	Specific gravity of urine.	Quantity of sugar passed from kidneys, in ounces.	Quantity of sugar contained in food, in ounces.	Water drank, in ounces.	Tea drank, in ounces.	Food eaten.						Stools.	Perspiration.	Remarks.
									Eggs.	Meat, in ounces.	Bread, fermented, in ounces.	Bread, unfermented, in ounces.	Dry farina, in ounces.	Sugar, in ounces.			
May 8	11	481		1.033	16522												
" 9	11	240	259	1.013	2566	1440	197	60	6	16					None	Moderate	
" 10	11	204	214	1 013	2083	1440	154	60	8	16					1	Profuse	Weighs, to-day, 168 lbs.
" 11	11	150	166	1.026	3430	3744	106	60	6	16	6				None	Profuse	ʒij of sweat collected; contains sugar.
" 12	11	159	175	1.033	5026	3744	115	60	2	16	6				None	Profuse	
" 13	11	165	176	1.030	4547	3744	116	60	5	20	6				None	Considerable	Mucus from bronchial tubes contains sugar.
" 14	11	143	156	1.006	208	None	156		6	16			1		3 loose	Considerable	
" 15	11	75	84	1.021	992	None	84		6	16			3		None	Scanty	
" 16	11	52	98	1.034	1263	1400	39	59	6	24			4		3	None	Weighs, to-day, 168 lbs.
" 17	11	86	165	1.029	1964	1370	107	58					10		3	None	Yesterday's stools contain sugar in abundance.
" 18	11	63	125	1.024	925	None	125		6	24					2	None	
" 19	11	39	104	1.024	325	None	104		6	32					2	Moderate	Detected sugar in sweat to-day.
" 20	11	84	93	1.031	2088	None	93		6	32					None	None	
" 21	11	133	150	1.030	3539	1440	90	60	6	16					1	Moderate	Weighs, to-day, 162 lbs.
" 22	11	344	390	1.037	12800	27820	230	160						44	None	None	Sugar produced nausea, but no vomiting.
" 23	11	264	293	1.034	9065	15840	113	180			30				None	None	
" 24	11	251	273	1.036	8888	14400	153	120			30				None	None	
" 25	11	169	180	1.036	5732	17856	60	120				39			1	None	
" 26	11	228	260	1.034	7830	17856	140	120		16		39			2	None	Weighs, to-day, 163½ lbs.
" 27	11	321	351	1.030	8461	17856	231	120		16		39			1	None	
Jan. 21, 1852	11	234		1.033	7306	18432		None			48				3 loose	None	
" 22	11	252		1.030	7162	18432		None			48				1 loose	None	

An examination of the preceding table allows us to make the following deductions:—

In the first place, that the quantity of urine is in itself no measure of the extent of the disease, it being regulated by the quantity of fluid drank, the perspiration, the number of fecal evacuations, &c. That in no instance was the quantity of urine passed greater than the amount of fluid drank, although a writer in the October number of the *Archives Générales de Paris*, assuming that the contrary was always the case, has endeavoured to prove that in diabetes a portion of the water in the renal secretion is produced by the union of hydrogen and oxygen within the body. On comparing the two columns of fluid drank and fluid passed, which I have placed side by side for better comparison, it will be seen that the relation between the two is very exact, and becomes more or less disturbed in proportion to the number of stools and the profuseness of the perspiration.

The quantity of sugar, although in a great measure dependent upon, is not always in proportion to, the amount of urine passed. A certain quantity of sugar is to be eliminated by the kidneys, and a proportionate amount of water is necessary for its solution. This want is intimated to the sensorium which seeks to supply it, just as a farther supply of material for carrying on the functions of the animal body is intimated by the sensation of hunger. And I ascertained, in the case of the patient under consideration, that when he was made to drink more or less fluid than he desired, the quantity of sugar remained the same, the specific gravity of the urine only undergoing alteration. For this reason he was allowed to drink an unlimited quantity of water, so that he rarely complained of thirst. In calculating the amount of sugar in his urine and food, I do not pretend to have been perfectly accurate; but, as my object was to obtain facts which would enable me to institute comparative results, I feel assured the mode of proceeding has been sufficiently exact. The quantity of urine, and the specific gravity at each period of voiding it, were accurately determined, and the amount of solids calculated by the ordinary table. I had previously ascertained from analysis that the usual healthy ingredients were all present in about their normal quantity, and as these vary, in a healthy individual, from 600 to 700 grains in twenty-four hours, I assumed them to be 650 grains, which amount was deducted from the whole solids, and the remainder considered as sugar. The quantity of this substance in the food was ascertained by taking the analysis of the different articles of diet, as laid down by different authorities, and estimating the quantity of sugar, and of substances capable of forming it, in each separately.

On comparing these two results, it will be seen that, although on five days no sugar or those substances capable of forming it were taken as food, yet, nevertheless, an average of 707 grains was passed each day from the kidneys; thus establishing the fact, previously stated by Bernard, that the source of the sugar is due to some cause beyond the non-conversion of the saccharine and amylaceous elements of food. Taking this fact into consideration, it is shown that the additional proportion of these substances, as diet, influences directly the quantity of sugar excreted. And whether the food consists of sugar alone, or a combination of sugar and starch, the result is nearly the same. Thus taking into consideration the quantity contained in the fecal discharges, on forty-four ounces of pure sugar the same proportionate amount was excreted as on thirty ounces of leavened, or thirty-nine ounces of unleavened bread.

I have arranged the following table to show the aggregate and average

amounts of sugar and urine passed between the different hours of the day, for fifteen days, at various intervals:—

Hour of day.	Aggregate quantity of sugar, in grains.	Average quantity of sugar for each day.	Aggregate quantity of urine, in ounces.	Average quantity of urine for each day.	
7 to 8 P.M.	4329	288	145	10	
8 to 9	5356	357	186	12	
9 to 10	5434	362	194	13	
10 to 11	7019	468	229	15	
11 to 12	1008	67	48	3	
12 to 1	6119	408	175	12	
1 to 2	1590	106	60	4	
2 to 3	3477	232	110	7	
3 to 4	3924	262	122	8	
4 to 5	2468	164	68	4	
5 to 6	3426	228	104	7	
6 to 7	2438	163	74	5	Breakfast.
7 to 8 A. M.	1836	122	54	4	
8 to 9	1754	117	55	4	
9 to 10	2548	169	82	6	
10 to 11	6924	462	209	14	
11 to 12	4312	287	133	9	Dinner at 12.
12 to 1	5047	336	154	10	
1 to 2	6597	439	197	13	
2 to 3	6459	436	219	15	
3 to 4	8636	576	301	20	
4 to 5	9622	630	338	25	
5 to 6	9154	610	298	19	
6 to 7	6545	436	214	14	Supper.
		7741		253	

It will be seen, on reference to the preceding table, that during the seven hours occurring between twelve and seven o'clock, or those immediately after the ingestion of the principal meal, and under various modes of treatment, the average quantity of sugar passed is 3459 grains, or very nearly one-half of the whole amount. And, moreover, that the same is true in regard to the quantity of urine, 116 ounces having been voided in the same interval of time. Another interesting fact is also here exhibited. After each meal, both the quantity of sugar and of urine commences and goes on to increase in regular progression up to the fourth hour, when it again decreases in nearly the same proportion. This table is made up of one hundred and forty-four separate observations, and the average specific gravity of the urine for the whole number is 1.0305.

A quantitative analysis of the amount of urea was made on three separate occasions. The mode of proceeding was to evaporate the urine over a water-bath to about one-fourth its bulk. From thirty to forty ounces were used for this purpose, and the urea was obtained in the form of a nitrate or an oxalate. It amounted to 90.56 grs., 102 grs., and 121.6 grs., respectively. We will not undertake to say that all the urea contained in the specimen examined was thus obtained, and shall, therefore, draw no conclusions from its deficiency.

Table showing the comparative Effects of Treatment for 9 months continuously.

Date.	Quantity of urine in 24 hours, in ounces.	Quantity of sugar in urine in 24 hours, in grains.	Quantity of sugar in food in 24 hours, in grains.	Medicine taken during the day and the week previous.	Stools on the day of examination.	Weight on the day of examination.	Remarks.
June 1	313	11657	19200	None		165½	
" 8	401	11380	19200	Cod-liver oil, 9ʒ per week		170	
" 16	358	9000	19200	Cod-liver oil, 7ʒ per week	2	166½	Diarrhœa last week
" 22	440	14960	19200	Cod-liver oil, 20ʒ per week	4	170½	
July 12	342	9950	19200	Cod-liver oil, 10ʒ per week; aqua ammonia, 5 drops 3 times daily	2	173	Gained 7¼ lbs. on 56ʒ cod-liver oil in 42 days.
" 20	278	7134	20000	1-20th gr. of strychnine, 3 times daily			Pus from hand contains sugar.
" 25	136	3830	19800	Strychnine, the same	2	170½	Slight diarrhœa stools contain sugar.
" 28	78	2000	18200	1-15th gr. of strychnine, 3 times daily; 9ʒ cod-liver oil per week	4 loose	170½	In hospital for diarrhœa.
Aug. 18	150	3550	22000	Strychnine and cod-liver oil, the same	2	170½	Has taken in 20 days 32ʒ of cod-liver oil.
" 22	184	5520	21500	Strychnine 1-20th gr. 3 times daily			
Sept. 7	200	4070	21950	Strychnine 1-10th gr. 3 times daily		166	
" 15	90	2500	20080	Strychnine 1-7th gr. 3 times daily			Medicine has produced stiffness of neck, and increase of venereal desire.
" 21	63	867	21500	Strychnine 1-6th gr. 3 times daily	3		Only 30ʒ were passed in first 18 hours.
" 29	247	8000	18100	None	2	162	
Oct. 5	177	4961	24400	Strychnine 1-12th gr. 3 times daily	2	157½	
" 12	187	4630	23200	Strychnine 1-7th gr. 3 times daily; cod-liver oil 10ʒ per week		161½	
" 19	116	2688	24200	Strychnine 1-6th gr. 3 times daily; oil, the same		165	Has gained 7½ lbs. on 20ʒ cod-liver oil in 2 weeks.
" 22	40	1000	No food	None	4 loose		Sools equal 1 gallon; contains sugar.
" 24	39	689	920	None	3 loose	162	
" 25	43	1017	4520	Strychnine 1-6th gr. 3 times daily	1		
Nov. 2	90	2467	26300	Strychnine, the same		166	
" 9	103	2037	36000	Mur. tinc. ferri 10 drops, 3 times daily	3 loose		
" 16	223	5264	36000	Mur. tinc. ferri 20 drops, 3 times daily	2 loose	164½	
" 21	267	6927	36000	Iod. potass. 3 grs. 3 times daily	5 loose	160½	Detected iodine in urine.
" 30	486	13728	36000	Creosote 1 drop; naphtha 10 drops, 3 times daily	1		Medicine produces great discomfort.
Dec. 7	442	12336	19100	Cod-liver oil, 8ʒ per week	3	167	
" 14	572	15192	21000	Cod-liver oil, 6ʒ per week	1	167	
" 21	515	15784	21000	Cod-liver oil, 6ʒ per week	2	168	
" 28	648	16708	21200	Cod-liver oil, 11ʒ per week	3	169½	
Jan. 3	612	18972	22000	Whiskey, 3ʒ daily	1	172	Has taken 40ʒ of cod-liver oil in 30 days, and gained 11½ lbs.
" 8	648	19438	21000	Whiskey, 3ʒ daily	1	170	
" 13	206	4836	21000	Strychnine 1-9th gr. 3 times daily	3	170	
" 20	172	2364	22000	Strychnine 1-6th gr. 3 times daily	2	169½	
" 29	522	16704	23300	None	2	168	
Feb. 15	520	19030	23300	Calomel 1 gr.; opium 1¼ gr. once daily	4	171	Taking this for 2 weeks; rises 4 times each night.
" 22	420	11950	24200	Ergot 3 grs. 3 times daily	4	180½	Says he is getting well; rises but once at night.
March 1	703	20440	26000	Ergot 3 grs.; iod. ferri 2 grs.; strychnine 1-10th gr., 3 times daily	3	171	
" 4	322	13860	25500	None	2	172	

Inasmuch as it is only of late years that we can conclude with certainty that the cases reported as diabetes were in reality that disease, we must take with considerable reservation the many accounts of their successful treatment. In the second case here reported, the patient believes himself cured, and looks to be in perfect health; but he is still passing from four to five ounces of sugar from his kidneys daily. And it is certain that, latterly, the journals less frequently contain reports of cases of this disease treated successfully. Of the ten or twelve that have fallen under my observation, most of them through the kindness of my friends, not one, so far as I know, has ever recovered.

We will now examine, in detail, the effects of treatment in this case. Each medicine was continued for at least one week, and the urine examined at the end of that period. It is impossible to make any exact comparison of these various modes, unless we could ascertain the amount of sugar passed in the stools and from the skin, as well as from the kidneys. And an examination of the preceding table will convince any one that an estimation of the increase or diminution of sugar in the urine is valueless unless, at the same time, allowance be made for the quantity passed in the fecal evacuations. The amount contained in the sweat we are forced to omit; but, as the condition of the skin remained nearly the same during the time the patient was under treatment, particularly for the last four months, we can the more readily afford to throw this element out of consideration. We endeavoured to ascertain accurately the amount of sugar contained in the stools, but with little success. There were, however, periods when he was kept, as nearly as possible, from day to day, under the same conditions, both as regards diet, exercise, and medicine; and we then remarked that, when the stools were about the same in number and quantity, the amount of sugar contained in the urine varied very little, but was increased or diminished in proportion to the fecal evacuations. From this fact, and one or two rough analyses of the fecal matters, we estimated the average amount of sugar in each stool to be about 1300 grains, and we shall assume this quantity in considering the effects of the different remedies. Whether this 1300 grains be too large or too small, the proportionate amounts remain nearly the same, and we subjoin below a comparative table of the different quantities of sugar passed from the kidneys and bowels together, while under the influence of the above remedies.

		Grains.		Grains.
Strychnine	$\frac{1}{6}$ gr.	3369	Without medicine	14520
"	$\frac{1}{7}$ gr.	3565	Creosote and naphtha	15028
"	$\frac{1}{10}$ gr.	6250	Cod-liver oil, 6ʒ per week	15058
"	$\frac{1}{15}$ gr.	6425	" 10ʒ per week	16108
"	$\frac{1}{30}$ gr.	6360	Pulv. ergot .	17150
Mur. tinc. ferri	10 drops	6900	Cod-liver oil, 20ʒ per week	20160
"	20 "	8264	Whiskey .	20504
Aqua ammonia	5 "	12550	Calomel and opium	24230
Iod. potass.	3 gr.	14270	Ergot, strychnine and iron	24340

Strychnine.—The amount passed without medicine is obtained from the

average of eleven analyses. We see, therefore, that the influence of strychnine exerts by far the greatest control over the quantity of sugar passed in the urine and feces. The patient was kept under its influence for various periods, amounting in all to four months. It is here shown that, under doses of one-twentieth of a grain, the amount is diminished to less than one-half, and under one-sixth of a grain to less than one-fourth. For three successive days he was kept upon a meat diet, and one-sixth of a grain of strychnine administered three times daily. The quantity of sugar, on the third day, was diminished to 132 grains. This was on the 30th of October, and was the smallest quantity we ever found in this patient's urine.

Mur. Tinc. Ferri.—This remedy, in doses of ten drops, diminished the sugar one-half; but on increasing the dose to twenty drops, a notable increase manifested itself, though still showing the beneficial effects of the medicine.

Aqua Ammonia.—The diminution here amounted to one-seventh. Larger doses were tried, but they produced so much uneasiness that they had to be discontinued.

Iodide of Potass.—The effect of this remedy over the excretion of sugar was little or none. It produced pain in the bowels and diarrhœa.

Creosote and Naphtha.—These also produced great inconvenience, and their effect was to increase slightly the quantity of sugar.

Cod-liver Oil.—In whatever doses this medicine was administered, its effect was to increase the amount of sugar. When six ounces per week were taken, the difference was slight; but when increased to twenty, one-third more sugar was passed. One fact, however, is worthy of notice. The patient, under this remedy, always gained weight, and, with the exception of the period when ergot was administered, only at that time. In forty-four days, on four pounds of oil, he gained nineteen pounds.

Pulv. Ergot.—The patient, under the influence of this remedy, gained in one week nine and a half pounds, but the amount of sugar increased one-sixth.

Whiskey.—This increased greatly the quantity of urine, as might be supposed, and also the sugar, which amounted to one-third more than when he was taking no medicine.

Calomel and Opium.—This was continued for two weeks, till the patient was brought decidedly under the influence of the mercury. The calls to urinate became more frequent, and the amount of sugar became nearly doubled.

Ergot, Strychnine, and Iod. Ferri.—Under this combination, the excretion of sugar was about the same as the preceding. He complained greatly of the mixture, and it will be seen that the largest quantity of urine was passed by him at this time, amounting to forty-four pints.

In concluding these remarks on the subject of treatment, we have seen that those remedies which act directly upon the nervous system exert by far the greatest power in lessening the amount of sugar in the secretions. And con-

sidering that the formation of this substance in the body was a natural process, and that our aim should be, not to prevent its formation, but to rouse up and strengthen the vital functions, in the course of whose normal action it is destroyed and eliminated from the system, we prescribed strychnine, and the result, in some measure, has justified our anticipations. It is needless to restrict the patient to an animal diet, for, although the prominent symptoms ameliorate under this treatment, the patient is not in reality better, and, in a majority of cases, the discomfort produced by the deprivation of saccharine and amylaceous food is not counterbalanced by the diminished thirst and the less frequent calls for micturition.

Case II.—*January* 10, 1852.— —— ——, a lawyer by occupation, and 37 years of age; short, stout, and having every appearance of being in robust health; applied for treatment on account of suppuration in the internal and external ear. He had lived freely for many years, drinking, principally, whiskey, but was never sick in his life, except a slight attack, three years since, of what was called rheumatism, seated in his ankle and wrist. He has been discharging purulent matter from his ear for two weeks, which discharge had been preceded by intense pain and total deafness of that side. Leeches and antiphlogistic treatment generally were ordered. On the 19th of January he complained of some pain in the right instep, but there were no external evidences of disease. On the 20th, we found that the discharge from his ear had suddenly ceased, and that he heard a watch tick distinctly, at a distance of two feet, when the day previous he could only hear it when placed directly in contact with his ear. The pain in the instep had increased, and there were swelling and redness along the course of the tendons. On the 22d, gout in both feet was well declared. On the 24th, in both wrists, and the joints of both forefingers, so that he cannot walk or use his hands in the least. His intellect is somewhat disturbed at night, and he is sleepless, but there is no tremulousness. Ordered whiskey, Tarrant's aperient, and colchicum, the latter in doses of ten drops only. His urine, which previous to the attack had been high coloured and free from albumen, was, at this time, pale and copious, and contained albumen in considerable quantity, but no sugar. On the 25th, disease the same, urine 1.035, albumen less in amount, no sugar. On the 26th, less albumen, but some evidences of sugar; for, when the albumen was coagulated and filtered from the urine, the residue gave a slight canary tint on heating it with Barreswil's liquid. On the 28th, disease subsiding, but urine contains sugar decidedly, as well as albumen, and, on standing for a few hours, throws down a copious deposit of uric acid sand. This is the first time this has been the case. On the 29th the albumen had disappeared entirely, and has not again made its appearance, but the sugar remained. The urine was of a greenish tinge, oily consistency, and strong saccharine odour, with a specific gravity of 1.036.

Feb. 1. The swelling of the joints is subsiding, and he is walking about. Urine the same, sp. gr. 1.041, passes 150 ounces in twenty-four hours, containing nearly eleven ounces of sugar.

4*th.* Passing ten ounces of sugar daily from his kidneys. Ordered strychnine and mur. tinc. ferri.

13*th.* Urine contains seven ounces of sugar.

24*th.* Urine contains four ounces of sugar; medicine continued.

29*th.* Urine contains five ounces of sugar.

Remarks.—I have reported the preceding case for many points of interest that it possesses. In the first place, it illustrates the early history of the disease. The association, at the commencement, with albumen, is probably accidental. The man's health was good till attacked by suppurative inflammation of the ear. The remedies for that affection prostrated his nervous system, and induced an attack of gout which he might otherwise have escaped. The albumen made its appearance in the urine from simple congestion and effusion from the kidneys, produced by their efforts to eliminate irritating materials. And these depressing causes united induced the presence of sugar in the urine in a patient, no doubt, already predisposed to diabetes. We believe this is the first case reported in which gout and diabetes have co-existed, and it is certainly an unusual event to observe uric acid crystals spontaneously deposited in saccharine urine.

Pathology of the Disease.—It is only of late years that any insight has been obtained in regard to the morbid processes that take place in diabetes, and it is needless in these remarks to go into any review of the untenable grounds that were assumed to prove its location to be in the kidneys. Bouchardat, following up Rollo's suggestion of there being an abnormal principle in the gastric juice not found in the healthy state which acts upon the starch of the food and converts it into sugar, made a considerable advance, but he did not embrace the whole matter. Both McGregor and himself, as well as other observers, ascertained that the matters vomited by diabetic patients contained sugar, whereas in healthy digestion no such result ensued; and they deduced, therefore, that the first step in the morbid chain started from the stomach. Had they examined all the available secretions of the same patient, they would have discovered that sugar was present in them all, for it is now well ascertained that in these cases it exists already formed in the gastric juice. For we ascertained, in the case here reported, that the presence of sugar may be very readily manifested in the matters vomited, when the previous meals consist of eggs and meat alone. Mialhe's theory, that diabetes is dependent on a neutral or acid state of the blood, needs only for refutation the fact that in every case of the disease where this fluid has been examined the reaction has been of its normal alkalinity, as we found it to be in the blood of the patient under consideration.

In regard to Professor Graham's experiments in University College Hospital, he is evidently wrong when he states that "the quantity of saccharine matter in the urine never exceeds the starch and sugar in the food." On referring to the first table in this article, it will be seen that from May the 15th to the 21st, a period of seven days, 2770 grains of sugar, or those substances capable of forming it, were taken as food, and then on the 16th and 17th only; and yet, 5765 grains, or more than double the quantity, were passed by the kidneys alone. This fact proves, what Bernard has already asserted, that sugar is eliminated by the kidneys even when none is taken into the stomach. And although Bouchardat and others are correct in stating that saccharine and

amylaceous food influence the amount of sugar in the urinary secretion, yet the fact stated above and supported by Bernard's previous experiments points to another, and in all probability a more important source for its production. In the July number of the *American Journal*, Dr. Donaldson, of Baltimore, has given in detail Bernard's experiments, proving the existence of sugar in the normal liver; and has detailed his series of experiments on animals, proving that this substance may be produced at will in the urine. We will examine further on the light that these facts throw upon the disease under consideration.

There can be no doubt that a portion of the sugar found in the various fluids and secretions of the body of a diabetic patient owes its origin to the amylaceous and saccharine elements of the food. We know that in healthy digestion, the atom of starch which subserves merely the purposes of respiration, and can by no process be converted into any of the animal tissues, during its elimination from the body goes through the following changes: starch, dextrine, sugar, vegetable acid, and carbonic acid. But from some stoppage in these changes the series is arrested at the sugar, which in this form is eliminated by the different excretory organs. What this arrest is, and where it is located, it is impossible in the present state of our knowledge to say, inasmuch as the only information we possess is the fact that when starch is taken into the stomach it is eliminated as carbonic acid and water; and we assume these intermediate stages to occur from knowing the changes that the same atom of starch would undergo out of the body.

We have long known, from the researches of Dr. Bensch, that the milk of carnivorous animals, fed exclusively on flesh, contained sugar of milk; and the announcement of the fact that the livers of the same animals kept on an animal diet, as well as those of the human subject living on ordinary food, also evidenced the presence of sugar, was not calculated to excite very great surprise. The fact, however, being now well established, we can no longer consider as tenable the idea so long inculcated, that animals had no power to create any organic principle found in their bodies, for it is here proved that sugar may be formed from nitrogenized materials. Bernard having ascertained that this substance existed normally in the right auricle of animals, traced it down through the ascending cava and the hepatic veins to the liver, beyond which point he was unable to discover it. Now knowing the fact that, if a small quantity of sugar be added to some freshly drawn blood and exposed to the action of the air, the sugar disappears, we can readily understand how this substance, thus proved to exist in the healthy animal economy, can be consumed in the lungs, so that no trace of it is perceptible in the urine. Bernard furthermore ascertained that this sugar, like other secretions, was dependent upon the integrity of the nervous system, and that, by irritating the different nervous centres, which he ascertained generally produced an increased quantity, he occasionally found it completely suspended. This may explain why it is

that the urine of diabetic patients frequently loses its saccharine character a short time before death.

It has been heretofore stated that the blood of the portal vein contains much more fat than the hepatic, the proportion being as 3.2 to 1.9; and as a very close relation between the elements of sugar and cholalic acid, the principal organic ingredient of bile, with glycerine and fatty acid, which together constitute fat, can be readily shown to exist, it would seem very probable, as M. Schmidt, a German physiologist, suggests, that this extra amount of fat going to the liver, may be transformed into sugar, and thus account for the presence of this substance in that organ. Thus:—

Fat acid + 14 oxygen	= Cholalic acid + 8 water.
$C_{48}H_{47}O_3$ + 14 oxygen	= $C_{48}H_{39}O_9$ + 8 HO.
2 eq. Glycerine + 4 oxygen	= Sugar + 2 water.
$C_{12}H_{14}O_{10}$ + 4 oxygen	= $C_{12}H_{12}O_{12}$ + 2 HO.

This would be very satisfactory; but, unfortunately in some respects for the theory, Bernard ascertained that this apparent excess of fat in the portal vein was due to regurgitation from the liver, where it is in reality formed; and that, if the portal vein be tied immediately on cutting through the abdominal parietes, instead of the fat being in excess, it will be found in less quantity than in the hepatic veins.

But that a certain relation does exist between these two substances, and possibly after the mode above stated, there can be no doubt; and the singular fact has been also stated by Bernard that, when the medulla oblongata is punctured, the amount of fat diminishes just in proportion as the sugar increases. In addition to this, M. Guillot states that, in diseases where there exists an interruption of the normal pulmonary circulation, such as is produced in phthisis and pneumonia, there is a quantity of fat found in the lungs which does not exist in other diseases. This will probably explain the cause of the fatty liver so common in phthisis; for were this circulation not permanently embarrassed, the fat would be deposited in the cellular tissue, or consumed in the lungs; but as it is, these organs not ridding themselves of it, it first saturates them, and the remainder, as it is secreted, remains in the liver. Hence the emaciation, which is wholly due to the want of fatty matter in the cellular tissue, which occurs in phthisis. On the other hand, the lungs, in diabetes, contain little or no fat, but large quantities of sugar; and although emaciation is one of the most prominent symptoms of this disease, yet the cause is different from that which produces it in phthisis. In the latter case, it is from the accumulation of fat in the lungs and liver; while in diabetes it is from the fat undergoing excessive oxidation, and being thus changed into sugar.

If, then, the facts just stated have any bearing, we are principally to explain the pathology of diabetes as being dependent on some derangement of the changes that ordinarily take place between the fat and sugar secreted in the

liver. To assert what this derangement is, would lead us too far into the mazes of barren speculation.

That the sugar produced by the liver should be consumed by the lungs, explains the connection between this disease and some pulmonary affections which are so often found to co-exist. Not that the one disease produces the other, but, when more than the usual amount of sugar is secreted daily by the liver, any accidental disease of the lungs, by interfering with their aerating power, prevents a certain amount of sugar from being consumed, and which must therefore be eliminated from the system without undergoing any change. That innumerable cases of diseases of the lungs occur without any connection with diabetes, and, moreover, that diabetes frequently takes place without any pulmonary complication, as in the two cases here reported, proves, without doubt, that deficient respiration, although occasionally acting as an exciting cause, bears, in reality, a very small part in occasioning saccharine urine; and that the presence of sugar in the secretions is not due to the fact of its being secreted in a normal amount by the liver, and remaining unconsumed in the lungs, but to its being formed originally in excess. Taking this view of the case, we should expect that the temperature of the body would not be diminished below that of a healthy man living on a diet excluding starch and sugar. And, in reality, such is the case in the present instance. The temperature of a man in full health, and that of one labouring under dysentery, were taken at the same time, by way of comparison. In the healthy man, the thermometer in the axilla stood at 98°, in the dysenteric patient 96°, while in the one labouring under diabetes it was 99°.

A statement made by M. Regnoso, to the effect that he has found sugar in the urine of various persons labouring under acute and chronic affections which disappeared after convalescence, has been published in most of the journals within the past few months. I can only say, in reply, that of the many hundred cases in which I have examined the urine with a view of detecting sugar, I never found it in a single instance that was not, either at the time, or proved subsequently to be, a case of diabetes. Having control of a hospital averaging from ten to twelve patients, I examined, for the space of three months, the urine of each patient, during his sickness, with this very view, and in no instance did I ever detect sugar.

In conclusion, then, to express in a few words the whole of our knowledge of the pathology of this disease, we say that in a state of health sugar is formed in the liver; that this sugar may be secreted when only azotized food is used; that in all probability it is formed from the fat which is also produced in this organ; and that it is then conveyed by the blood, together with any sugar that may have been taken in as food, to the lungs, and there eliminated in the form of carbonic acid and water. That in diabetes, from some cause at present unknown to us, an unusual amount of this substance is formed by the liver, more than the lungs can dispose of, the surplus passing off by the different excretory and secretory organs; and that although an amylaceous or

saccharine diet increases the quantity, yet abstinence from these articles of food will not prevent it from making its appearance in the urine and other excretions.

For many of the ideas herein stated we are indebted to M. Bernard, and we cannot but think that science is under great obligations to him for the satisfactory proofs he has given of the functions of the liver, so long a *terra incognita* to pathologists. Indeed, its importance as an organ of *sanguification* as well as *depuration* ought readily to be admitted, when we consider its large size in proportion to the rest of the body, and the complexity of its anatomical structure.

Baltimore, *March* 7, 1852.

Art. VI.—*Extracts from the Records of the Boston Society for Medical Improvement.* By Wm. W. Morland, M. D., Secretary.

January 12.—*Angina Pectoris.*—Dr. Jackson exhibited the heart taken from a patient whom he had recently examined, and showing extensive ossification of the coronary arteries, without any other change excepting an atrophy of the ventricular portion of the organ; which last, as has been remarked by various writers, is probably owing to the diseased state of the nutrient vessels and the imperfect supply of blood. The case occurred in the practice of Dr. Webber, of Cambridgeport, and the patient was an old lady, 70 years of age, very fleshy, and had been subject, for five or six years, to paroxysms of great distress about the region of the heart, with numbness down the left upper extremity, lividity, and feeble pulse, obliging her to give up all active exercise.

The large intestine was loaded with fat, and, as frequently happens when this is the case, the mucous membrane formed numerous little herniary sacculi, many of them extremely thin, and some containing masses of indurated feces, as calculi are sometimes found in a sacculated urinary bladder.

At the next meeting, Dr. Jackson reported a hospital case that he had since examined, and in which the coronary arteries were ossified, but without any cardiac affection, so far as was known during life; though, after the patient's death, his wife reported, on inquiry, some symptoms that may have been referable to the heart.

Intussusception fatal, without complete Strangulation.—Dr. Snow exhibited the parts, and read a full history of the case sent by Dr. Cotting, of Roxbury, in whose practice it occurred. The patient was a healthy male infant, six months old. On Thursday, P. M., the 8th inst., it had two small, loose dejections, with traces of blood; about midnight, a large, loose, mucous, and bloody dejection; and towards morning another, without pain. On Friday morning, Dr. Cotting found it slightly unwell, with restlessness, nausea, and occasional distress, which was referable to the bowels. Hyd. c. creta was given; and, for the night, Dover's powder. On Saturday morning, the distress had greatly increased, but without any marked heat,